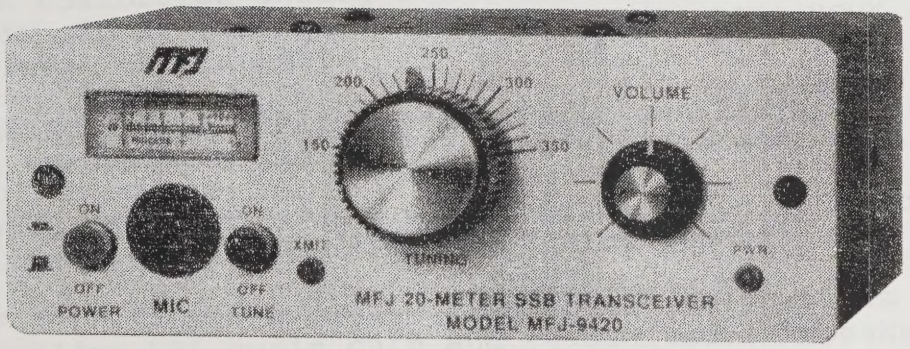
20 METER SSB TRAVEL RADIO



Model MFJ-9420

INSTALLATION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

MFJ ENTERPRISES, INC.

P.O. BOX 494, MISSISSIPPI STATE, MS 39762, USA

VERSION 1

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INTRODUCTION:

Congratulations on your choice of the MFJ-9420 20-Meter transceiver. The MFJ-9420 is especially designed to deliver performance you never thought possible from a low-power radio. Please read this manual carefully before attempting to operate your new radio. Let's begin with an introduction to some special features we think you'll like!

EASY TO OPERATE: A "back-to-basics" radio, the MFJ-9420 is simple to use. You'll be operating in minutes!

GREAT SENSITIVITY: Quiet DBM front-end and plenty of overall gain. If the signal is there, you'll hear it!

ANALOG S-METER: Adjust your tuner or aim your beam with pin-point accuracy. A calibrated analog S-meter measures even small variations in signal strength. Meter also monitors your speech-processing level on transmit.

EXCELLENT SELECTIVITY: Sharp ladder filter cuts adjacent chatter and focuses transmitter power where you need it most.

SMOOTH, STABLE VFO: Effortless tuning with custom-manufactured 8:1 reduction-drive ball-bearing VFO tuning capacitor.

POWERFUL AF OUTPUT: Big audio -- even in noisy locations -- from a special Philips BTL audio chip and ruggedized 3" speaker.

FULL-TIME RF SPEECH PROCESSING: Commanding speech cuts through QRM and competes with radios running far more power. Compare it with your 100-watt rig; you'll be amazed by the signal reports!

TRAVEL LIGHT: Packs the same punch as 50 Watt radios without the heavy 10-Amp power supply! Designed to run on NiCd's or the ultra-light MFJ-4110 AC wall-adapter supply.

RUGGED TRANSMITTER: Bullet-proof Motorola PA runs cool, tolerates 3:1 VSWR and accidental feedline shorts or opens.

MADE TO LAST: Conservative design, premium plate-through pc board, quality components, handsome brushed-aluminum panel, and a tough vinyl-clad case ensure years of dependable service.

CW ADAPTER AVAILABLE: Install the MFJ CW adapter board and jump to the low end to work CW. Semi-break-in keying and sidetone.

At home or on the go, you'll enjoy countless hours operating the MFJ-9420. Best of all, it's fully backed by MFJ's exclusive "No Matter What" 1-year guarantee. If it breaks, we'll take care of it!

QUICKSTART INSTRUCTIONS:

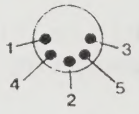
You'll need three things to get your MFJ-9420 on the air fast:

[] 12-14 Volt 2-Amp Power Source.
[] 600-Ohm Dynamic PTT Microphone
[] 20-Meter Antenna

1. POWER SUPPLY: The MFJ-4114 AC/NiCd Portable Power Pack or MFJ-4110 AC Wall-adapter Supply are especially designed to run the MFJ-9420. You may also use any 13.8-Volt supply or 10-cell NiCd pack as long as it delivers 2-A on peaks (12-Volt supplies will work fine -- but at reduced RF output). Use a 5.5mm OD x 2.1mm coaxial-type power plug (Radio Shack 274-1567) with (+) connected to the center pin:

2. MICROPHONE: The MFJ-9420 speech processor circuit was designed around the companion MFJ-290 600-Ohm Dynamic Microphone. Radio Shack's 21-1172 replacement microphone also plugs in without modification and works well. If the mike you select requires a plug, install a 5-Pin DIN connector (Radio Shack 274-003) as shown:

Pin 3: PTT Line
Pin 4: Mic Line
Pin 1,2,5: Ground



3. ANTENNA: The MFJ-9420 will function with any 20-Meter antenna exhibiting a VSWR of 3:1 or less (your home station antenna or the MFJ-1772 Portable Dipole should work fine). AVOID USING ANTENNAS WITH UNKNOWN OR HIGH VSWR. The MFJ-9420 PA is not protected by high-VSWR shutdown circuitry and you may generate out-of-band parasitics if a high VSWR load is present.

IMPORTANT OPERATING NOTES:

[] Your MFJ-9420 features a very potent speech processor. PLEASE RESIST THE NATURAL TEMPTATION TO SHOUT OR CLOSE-TALK THE MICROPHONE IN ORDER TO BE HEARD! Instead, hold the mic about 2" away and speak normally. The S-Meter should deflect about 1/2 scale as you speak -- although this may vary somewhat with antenna load. When operating in noisy environments, you may find it necessary to turn down the mic gain control (a screwdriver adjustment located on back panel) to reduce background noise.

[] The MFJ-9420 uses an analog VFO tuning dial which is inherently less accurate than digital readouts (on the plus side, analog tuning reduces phase noise, lowers power consumption, and saves you money). Please take the potential for dial error into account when operating near the edge of your authorized sub-band.

TECHNICAL SPECIFICATIONS:

RECEIVER SECTION:

Frequency Coverage:	14.150-14.350 MHz (14.000-14.100)*
Receiver Type:	Single conversion superhet
VFO Frequency:	4.150-4.350 MHz (4.000-4.100)*
IF Frequency:	10 MHz
IF Selectivity:	-6 dB at 2.5 KHz
AGC:	Audio-derived
Sensitivity:	<.5 uV for 12 dB S/N
Audio:	>1 Watt into 8 Ohms at 10% THD
Receive Current:	50-100 mA typical

TRANSMITTER SECTION:

RF Power Output:	10W Average Speech (8-10W CW)*
VSWR Tolerance:	3:1 VSWR
Maximum Current:	2.2 Amps peak at 13.8 VDC
Audio Enhancement:	RF-compression processor

* Requires CW adapter module

BLOCK DIAGRAM:

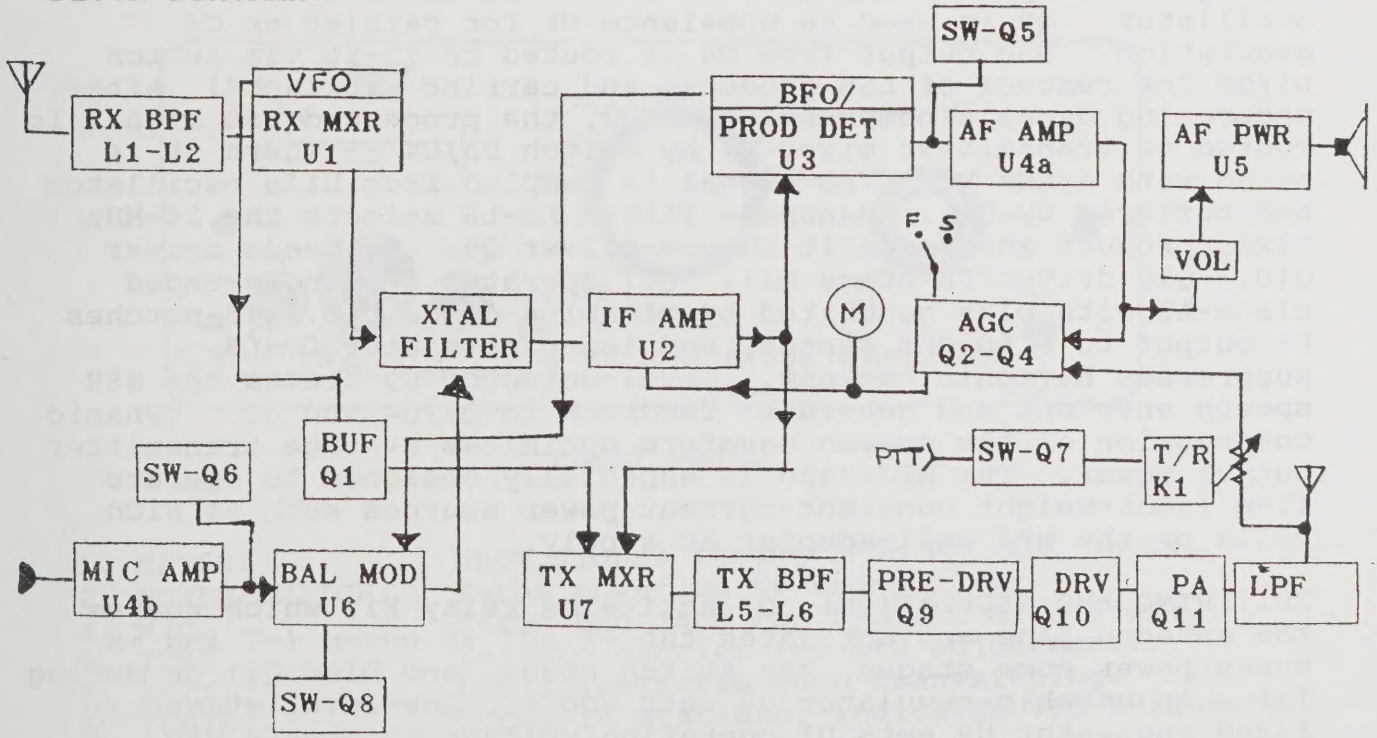


Figure 1.

THEORY OF OPERATION: Please refer to Figure 1.

RECEIVER: Four-pole bandpass filter L1-L2 preselects incoming 14-MHz signals. Active mixer U1 amplifies and converts signals to 10-MHz using a self-generated 4-MHz VFO signal. Crystal ladder filter Y1-Y6 sets message-channel bandwidth (diode-switching routes transmit and receive signals through the filter and U2). IF-amplifier U2 provides AGC-controlled IF gain in RX and RF-compression speech processing in transmit.

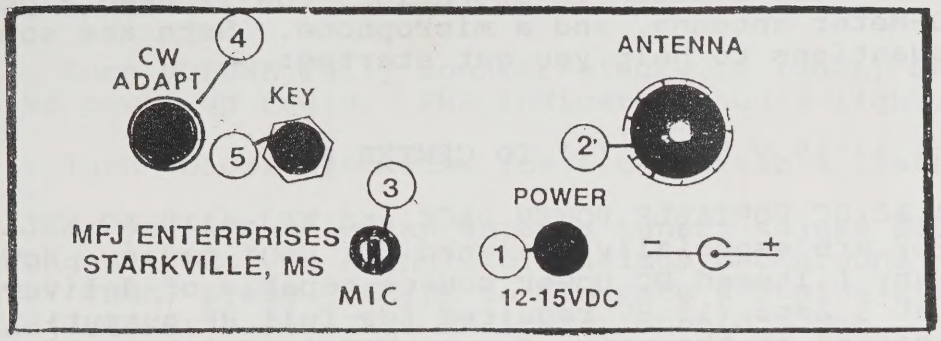
DC amplifier Q3/Q4 drives the AGC input of U2 and the S-meter circuit. In RX, AGC is audio-derived from AF pre-amp U4a (switch Q2 sets slow AGC decay for SSB reception). On transmit, processor control voltage is derived from PA level-detector D9 (Q2 sets fast decay for processor).

Receiver product detector U3 demodulates incoming SSB signals (10-MHz LO is self-generated by U3). U3's audio output feeds U4a, a preamp and active LP audio filter. U4a drives ACG detector D6/D7 (input to U4a is killed by switch Q5 during TX to disable the AGC path to U2). U4a also drives AF power amplifier U5 through the volume control. U5, which powers the speaker during RX, is gated into standby during TX to prevent residual feedthrough.

TRANSMITTER: Microphone speech amp U4b drives balance modulator U6 during TX (switch Q6 kills U4 output to prevent mic bleed-through via U6/U2 during RX. LO for U6 is derived from U3's BFO oscillator. Q8 is used to unbalance U6 for carrier or CW generation. DSB output from U6 is routed to Y1-Y6 via switch D1/D2 for removal of LSB products and carrier artifacts. After undergoing dynamic compression in U2, the processed USB signal is routed to transmitter mixer U7 by switch D3/D4 -- where it is mixed with 4-MHz VFO (VFO signal is sampled from U1's oscillator and buffered by Q1). Bandpass filter L5-L6 selects the 14-MHz mixer product and feeds it to pre-driver Q9. Q9 feeds driver Q10. Q10 drives PA stage Q11. Q11 operates in single-ended class-AB with bias generated by clamping-diode D10. T5 matches PA output to a 50-Ohm system, and low-pass filter L7-L8 suppresses harmonic content. Level-detector D9 tracks the SSB speech envelope and generates feedback to Q3/Q4 and U2. Dynamic compression of the speech waveform optimizes average transmitter output power. The MFJ-9420 is especially designed to operate from light-weight constant-current power sources such as NiCd cells or the MFJ wall-adapter AC supply.

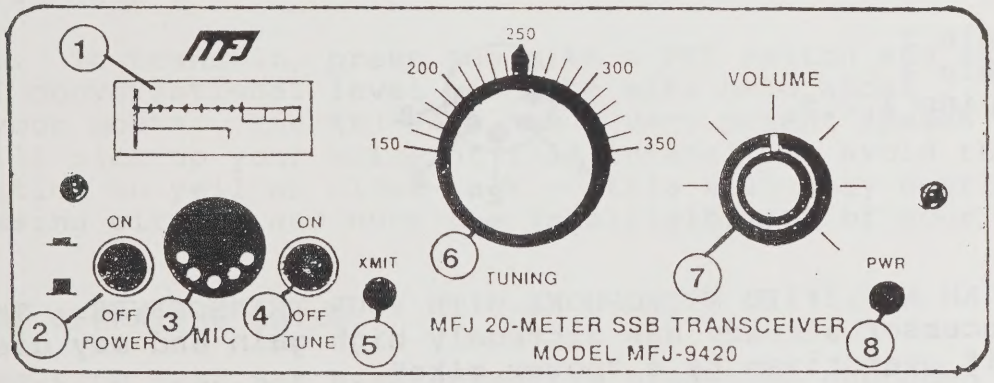
SWITCHING AND REGULATION: Q7 activates relay K1, which routes the antenna line and activates the +T and +R buses (+T and +R buses power some stages, key switch nodes, and bias Q11 on during TX). Adjustable-regulator U8 sets Vcc for low-level stages. Fixed regulator U9 sets U1 operating voltage to ensure VFO stability. Crowbar diode D11 and a pc-track fuse protect the radio from reverse polarity.

MFJ-9420 CONTROL LOCATION AND FUNCTION:



REAR PANEL

1. POWER JACK: 5.5mm OD, 2.1mm ID, (+) to center pin.
2. ANTENNA JACK: SO-239 for standard coax plugs.
3. MIC GAIN: Sets Speech-amp Gain (normal setting 12:00).
4. CW ADAPT: Engages CW adapter (accessory).
5. KEY: Accepts straight key or keyer.



FRONT PANEL

1. METER: Show signal strength on RX, ALC on TX.
2. POWER SWITCH: Turns power on to transceiver.
3. MIC: 5-Pin Din Jack for Dynamic Microphone.
4. TUNE: Injects carrier for ATU adjustments.
5. XMIT: LED illuminates when transmitting.
6. TUNING: Tunes in stations, indicates VFO frequency.
7. VOLUME: Adjusts listening level.
8. PWR INDICATOR: LED illuminates when power on.

SETTING UP YOUR MFJ-9420 PORTABLE STATION:

To put your MFJ-9420 station in operation, you'll need a power source, a 20-Meter antenna, and a microphone. Here are some specific suggestions to help you get started:

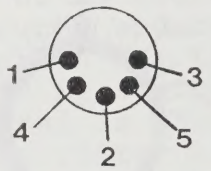
POWER SOURCE: 12-15 V @ 2A (+) TO CENTER PIN

The MFJ-4114 AC/DC PORTABLE POWER PACK and MFJ-4110 AC WALL-ADAPTER SUPPLY are especially designed for your radio. However, you may use any filtered DC power source capable of delivering 12-15 volts at 2 Amps (13.8V required for full RF output). The DC power connector at the rear of your MFJ-9420 is a 5.5mm OD, 2.1mm ID coaxial type jack. Extra plugs are available from Radio Shack stores (#274-1567). Always connect plus (+) to the CENTER PIN.

MICROPHONE: USE 600-OHM DYNAMIC

The MFJ-9420 speech circuit is designed especially for a 600-Ohm dynamic microphones such as the MFJ-290 (the MFJ-290 is supplied if you purchase the MFJ-9420M package). You may also use other suitable 600-Ohm desk or hand mics by installing a 5-pin DIN plug (Radio Shack #274-003). See installation diagram below:

PTT - pin 3
MIC - pin 4
GND - pins 1,2,5.



WARNING:

NEVER USE AN AMPLIFIED MICROPHONE WITH YOUR TRANSCEIVER. The speech processor already has extremely high gain and may distort severely if overdriven by a "power mike".

ANTENNA REQUIREMENTS: VSWR 3:1 OR LESS

The MFJ-9420 accepts most 20-Meter antennas with a VSWR of 3:1 or less. Use your regular station antenna or a portable 20-Meter dipole such as the MFJ-1772 ultra-light. For non-resonant wires, use a tuner such as the MFJ-971. Always "rough-tune" for maximum receiver sensitivity first using incoming signals and your S-Meter to find a peak. AVOID OPERATING INTO UNMATCHED HIGH-VSWR ANTENNAS. THE MFJ-9420 DOES NOT HAVE A HIGH-VSWR SHUTDOWN CIRCUIT AND BADLY-MISMATCHED LOADS COULD RESULT IN TRANSMITTER INSTABILITY AND GENERATION OF OUT-OF-BAND SIGNALS!

STEP-BY-STEP INSTRUCTIONS -- USING YOUR MFJ-9420 TRANSCEIVER:

STEP 1. Connect a suitable microphone, power source, and 20-Meter antenna.

STEP 2. Turn VOLUME fully counter-clockwise (down) and press ON switch to power up radio. PWR indicator should light.

STEP 3. Turn VOLUME clockwise for a comfortable listening level.

STEP 4. If you are using an antenna tuner, adjust ATU controls for strongest received signals or maximum background noise on the S-meter. Then, press CARRIER to generate a steady RF signal for final adjustment. Red XMIT indicator should light.

STEP 5. The VFO tuning range covers 14.150 - 14.350 MHz and the MFJ-9420 tuning dial was carefully calibrated at the factory. However, it is -- by nature -- an analog frequency readout that may be subject to some inaccuracy or misinterpretation. To ensure compliance with FCC rules, we suggest the following:

(a.) Periodically check the VFO dial with a digital transceiver or counter to confirm location of band-edges.

(b.) Avoid transmitting on the margins of your allocation unless you are certain the station you are calling is in "in band".

STEP 6. To transmit, press the mike's PTT switch and speak at normal conversational level with the mike held about 2 inches from your mouth. The MFJ-9420 has a very potent speech processor and will pick up your voice at full intensity. Avoid the natural temptation to yell or close-talk -- this will only overload the processing circuit and hurt the intelligibility of your signal!

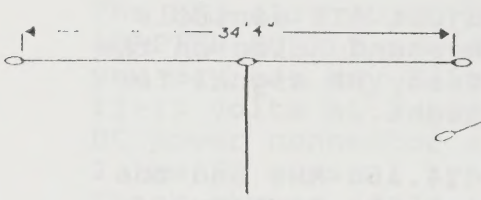
SPECIAL OPERATING NOTES:

The MFJ-9420 does not have automatic high-VSWR shutdown and you must provide a "reasonable" 20-Meter antenna to ensure proper operation. Whenever possible, use a low-SWR resonant-type antenna such as a dipole or tuned vertical. If you use an ATU (or a high-Q loop such as the MFJ-1786 or Isopole 10-30), carefully rough-tune first for maximum S-meter readings before activating the CARRIER switch.

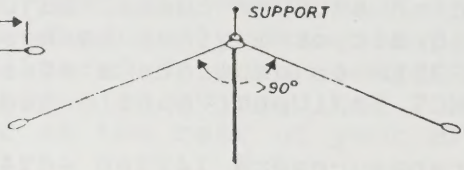
Under FCC Rules, licensed amateurs are solely responsible for the frequency of operation of their transmitters. MFJ cannot be held responsible for out-of-band operation due to misinterpretation or miscalibration of the MFJ-9420 analog VFO dial.

SIMPLE 20-METER ANTENNA SUGGESTIONS:

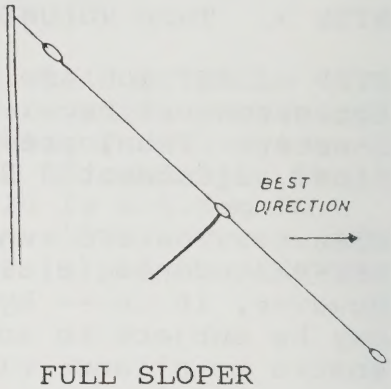
COAXIAL-FED DIPOLES: A wire dipole for the phone band should measure about 32'10" (16'5" per leg). Feed with RG-58U or RG-8X; raise high and in the clear for best performance. If you have only one high support, make an inverted V. The "full sloper" (sloping dipole) is also an excellent single-support antenna with some directivity.



DIPOLE

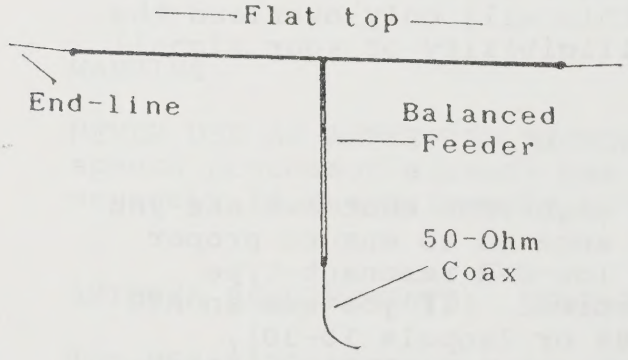


INVERTED V

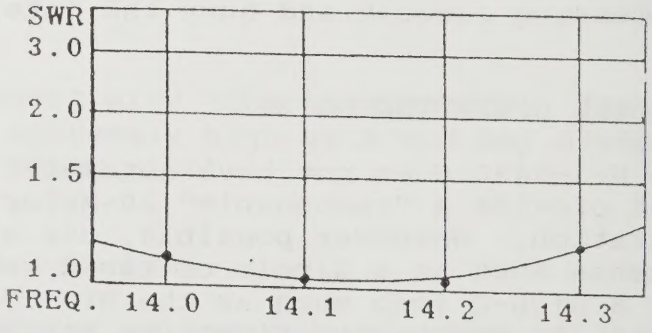


FULL SLOPER

MFJ-1772 PORTABLE DIPOLE: As an alternative to making a coax-fed dipole, consider purchasing the pre-assembled MFJ-1772 antenna. This is a no-compromise 20-Meter folded dipole complete with 30' of feedline -- all made from ultra light-weight 300-Ohm twinlead. Connect a random length of coax from the MFJ-1772 feedline to your rig and let the antenna's built-in 50-Ohm matching network do the rest. The antenna is pre-tuned, easy to handle, and sufficiently broad-banded to cover both the CW and phone band.



MFJ 1772 DIPOLE



TYPICAL SWR CURVE

WARNING: CONSTRUCTING OR ERECTING AMATEUR RADIO ANTENNAS IN LOCATIONS WHERE THEY MAY COME INTO CONTACT WITH ELECTRICAL POWER LINES MAY RESULT IN ACCIDENTAL INJURY OR DEATH!

GETTING THE MOST FROM YOUR MFJ-9420 STATION:

While spanning the globe with a small portable rig like the MFJ-9420 may SOUND difficult, it really isn't. High power and big antennas have never been a requirement for world-wide radio communication -- and still aren't. Despite the vast distances involved, hams consistently reach every corner of the planet running far less power than your MFJ-9420. How do they do it? Here are some proven tips guaranteed to work:

GROOM YOUR ANTENNA:

Inspect and clean all traps and contacting surfaces. Replace corroded hardware, dirty connectors, and aging coax. Retune for minimum SWR in the phone band.

Raise wire dipoles high and in the clear -- 40 to 60 feet is far better than 10 or 20. Carefully prune for minimum SWR. If you have only one high support, install an inverted V or sloper.

Multiband verticals (1/4-wave types) require at least 4 good 14-MHz radials -- add them if needed. Clean up corrosion and adjust your top section for minimum SWR in the phone band.

Avoid "compromise" antennas. When it comes to pure operating enjoyment, every dB you gain at the antenna pays big dividends!

USE PROVEN DX OPERATING TECHNIQUES:

Be a good listener -- search out and answer CQs, or call stations that have just completed QSOs (a practice called tailgating).

Never hesitate to call a weak station -- it may be QRP or using a marginal antenna. You may be much louder than you think!

Be realistic about diving into huge 20-meter pileups. Once a choice DX station hits the packet clusters and the big guns move in, calling may be a waste of time until the smoke clears.

Tune slowly and listen carefully. If one exotic station is coming through, there may be others you can work nearby.

Pay attention to DX forecasts and gray-line propagation. When the band is hot, power difference become much less significant. Operating just before the band goes out at night may yield strong signal reports from exotic locations with little QRM.

Don't be shy about calling. The MFJ-9420 has very potent audio and on-air tests indicate its signal is competitive with higher-powered radios. If your antenna is good, most stations won't even know you are running low power!

IN CASE OF TROUBLE, CHECK IT OUT FIRST -- THEN CALL US AT 800 647-TECH (800 647-8324): Your MFJ-9420 is fully backed for 1 year by MFJ's "NO MATTER WHAT GUARANTEE". After that, MFJ Customer Service Technicians will be there to help you keep your rig in top shape for as long as you own it. However, before you call us, please check through this list -- just to make sure the problem isn't something simple you can fix yourself!

1. RADIO DOES NOT POWER UP
 [] Is power plug okay, broken supply wire?
 [] Is supply or battery functional?
 [] Is reverse-polarity fuse open?

2. NO SIGNALS RECEIVED
 [] Is antenna disconnected or broken?
 [] Is TUNE switch stuck on?
 [] Is the band dead?

3. RADIO DOES NOT TRANSMIT OR KEYS ERRATICALLY
 [] Is microphone and connector okay?

4. ERRATIC TRANSMIT
 [] Is SWR high (above 3:1)?
 [] Is power source voltage low or "soft" under load?

5. AGC IS INEFFECTIVE OR S-METER IS NOT ZEROED
 [] Is Regulator okay (10.0 V on TP1)?
 [] Is AGC okay (4.3 on TP2?)
If TP1, TP2 okay and AGC works, rezero meter via R51.

6. RADIO DRIFTS IN FREQUENCY
 [] Is radio sitting in Sun, on hot surface, in cold draft?
 [] Was radio moved from extreme cold to warm (condensation)?
If you suspect condensation, allow radio to fully dry out.

7. POOR CARRIER SUPPRESSION
 [] Was radio moved from extreme cold to warm (condensation)?
 [] Was radio exposed to rough handling or shock?
To null, unplug mic and ground pin 3 to key radio. Adjust R36 and T3 for minimum carrier (monitor using a second receiver).

8. LOW TRANSMIT AUDIO:
 [] Is the mic a 600-ohm dynamic type?
 [] Is the MIC GAIN set too low?

9. NOISE ON TRANSMIT AUDIO:
 [] Is MIC GAIN set too high in a noisy room?
 [] Is mic next to a power transformer or motor?

If these checks don't uncover the problem, or if you don't feel qualified to make the prescribed adjustments, please call us for help at 800 647-TECH (800 647-8324).

FIELD ALIGNMENT PROCEDURES FOR THE MFJ-9420 TRANSCEIVER:

SPECIAL TOOLS, PARTS, TEST EQUIPMENT:
- AC Power Supply, 13.8 Volts @ 2 Amps
- Voltmeter
- Non-inductive Alignment Tool kit
- Frequency Counter
- Wattmeter with 50-Ohm Resistive Dummy Load
- 14-MHZ Signal Generator or other weak signal source
- General Coverage Receiver with digital readout

INITIAL TEST SET-UP:
- A. Remove transceiver cover.
- B. Connect 13.8 Volts Power Supply to Power Jack.
- C. Connect Microphone.
- D. Turn on unit.

VOLTAGE CHECKS AND ADJUSTMENTS: (use voltmeter)
- A. VOLTAGE REGULATOR: Set R64 for 10.0 V at TP1.
- B. RECEIVER AGC: Set R6 for 4.3 Volts at TP2.

VFO CALIBRATION:
- A. Tune VFO dial to 14.250 MHz (mid-band).
- B. Connect counter probe to U7 pin 6
- C. Adjust L3 for 4.255 MHz readout.

BFO FREQUENCY CHECK AND ALIGNMENT:
- A. Tune across 14.250 MHz. test signal (use generator).
- B. Identify 2 peaks in passband by watching S-meter.
- C. Carefully set VFO dial to lower-frequency response peak.
- D. Adjust BFO trimcap (C61) until CW note is 600 Hz.
- E. Recheck. First peak should be at 600 Hz, second peak around 2000 Hz. Pitch of CW tones should go DOWN as you tune UP in frequency, indicating USB operation.

CARRIER NULL: (use a second receiver to monitor beat note)
- A. Short mic pin 4 to ground to kill mic pickup.
- B. Key mic and monitor signal slightly off-frequency.
- C. Alternately adjust R36 and T3 for minimum carrier.

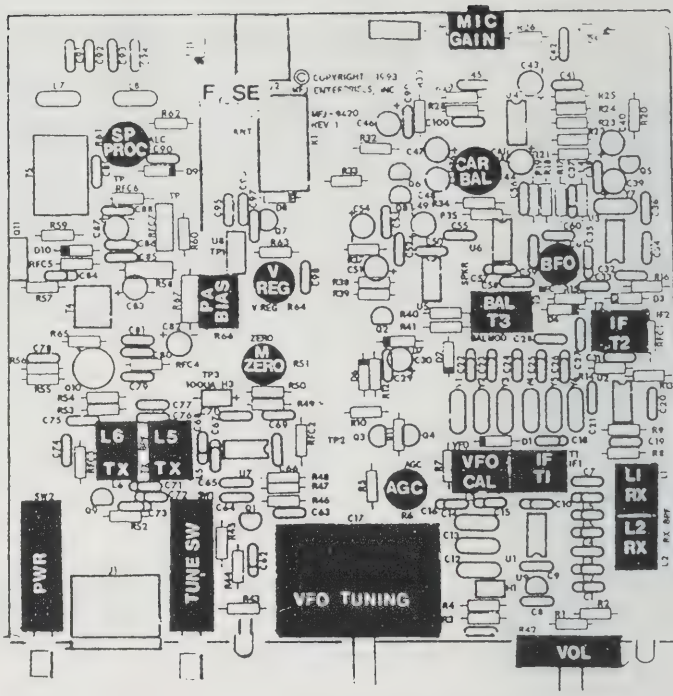
RECEIVER SENSITIVITY CHECK:
- A. Connect weak 14.250-MHz signal source to antenna jack.
- B. Tune in signal source for maximum S-meter reading.
- C. Touch up L1,L2,T1,T2 for max SIG Meter reading.

TRANSMITTER BANDPASS FILTER AND COMPRESSOR ALIGNMENT:
- A. Connect QRP Wattmeter with dummy load to ANT Jack.
- B. Turn R61 full CW, Press Carrier Switch (SW2).
- C. Carefully touch up L5 and L6 for peak output.
- D. Turn R61 CCW until RF output power drops by 10%.

If radio fails to operate properly after following these procedures, call 800 647-8324 for help.

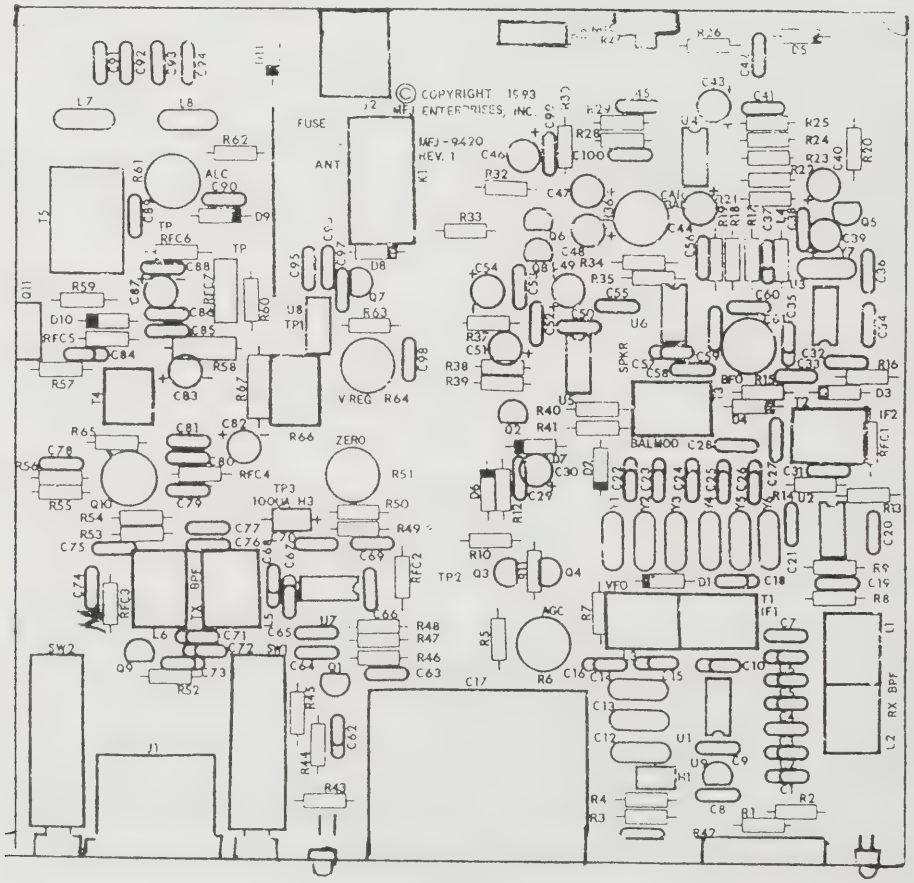
INTERNAL ADJUSTMENT LOCATIONS:

[] V-REG: Regulator voltage
[] AGC: U2 AGC threshold
[] M-ZERO: Panel meter zero
[] BFO: Carrier osc. freq.
[] VFO CAL: VFO freq. adj.
[] IF1,IF2: IF ampl. peak
[] L1,L2: RX front-end peak
[] L5,L6: TX filter peak
[] CAR-BAL,T3: Carrier null
[] PA BIAS: PA idle current
[] SP PROC: TX ALC level
[] MIC GAIN: TX audio level
[] TUNE SW: Full carrier out
[] PWR: Power on
[] VOL: AF Ampl. gain control
[] VFO TUNE: Sets operating freq.
[] FUSE: Reverse-polarity protect



*If reverse-polarity track-fuse opens, install a miniature 2.5-A pigtail fuse or a 3/4" hair-pin loop of #32 wire.

PARTS PLACEMENT, MFJ-9420:



DC VOLTAGE CHART - TROUBLESHOOTING GUIDE:

For advanced troubleshooters, the following are typical DC voltages found in the MFJ-9420.

Vcc = 13.8 (Supply Voltage)
TP1 = 10.0 (LM-317 Output)
TP2 = 4.3 (AGC Bias Voltage)

INTEGRATED CIRCUITS:

		-------- RX----------				--TX--	
Pin	U1	U2	U3	U4	U5	U6	U7
1							
2							
3							
4							
5							
6							
7							
8							

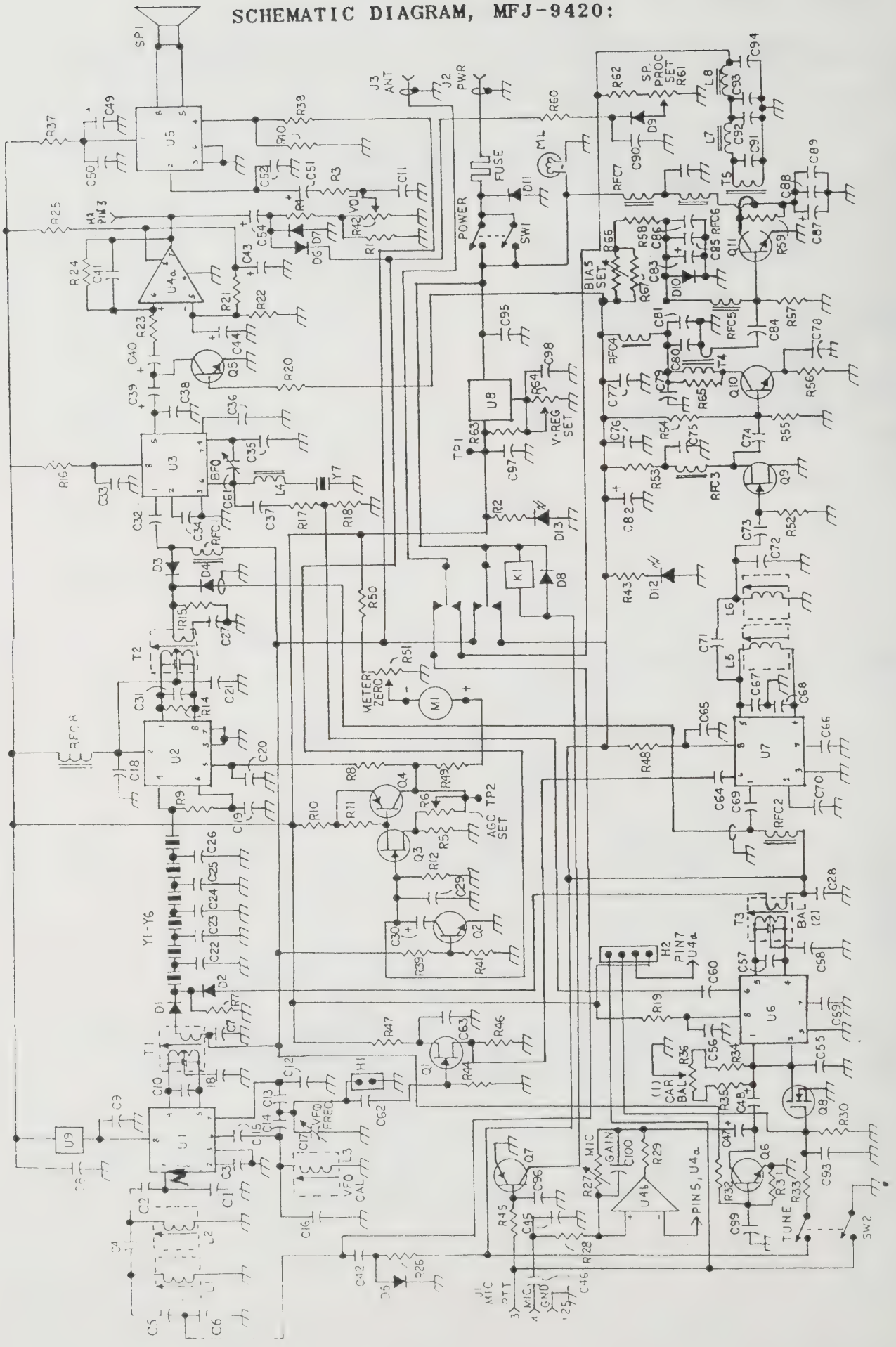
BIPOLAR AND JFET DEVICES:

D/E = Drain/Emitter
S/B = Source/Base
G/C = Gate/Collector
* = Check in transmit

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
D/E										
S/B										
G/C										

PA Q11: To avoid meter damage from RF, check Q11's collector in receive mode; full supply voltage should be present. Check base (bias) with PTT pressed; it should indicate about 0.6 VDC.

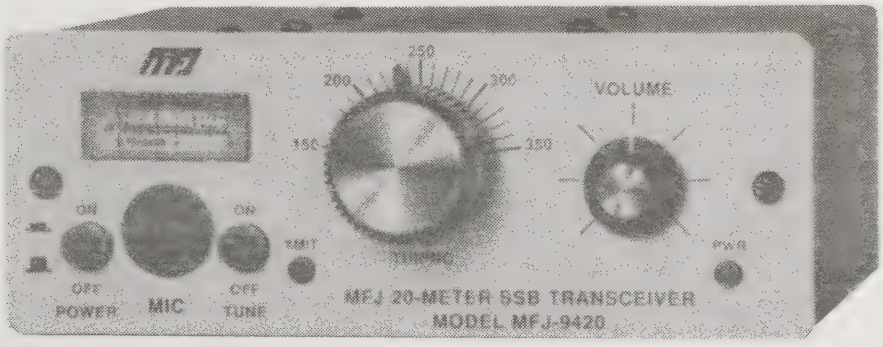
SCHEMATIC DIAGRAM, MFJ-9420:



MFJ-9420 Parts List

DESIGNATION	DESCRIPTION	MFJ PARTS #	DESIGNATION	DESCRPTION	MFJ PARTS #
C1,5,73	100pF, 50V Multilayer	205-0100	Q8	VN10KM	305-6005
C2	560pF, 50V Multilayer	205-0005	Q9	J310	305-6310
C3,7,11,18,19,20,21,27	.01uF, 25/50V Disc	200-0004	Q10	2N5109	305-0017
C28,29,34,36,38,42,45,52	.01uF, 25/50V Disc	200-0004	Q11	MRF-477	305-5477
C53,55,58,59,63,65,66,70	.01uF, 25/50V Disc	200-0004	R1,2,7,15,16,19,26,43	2.2K ohm, 1/4 Watt	100-3220
C75,76,79,85,88,90,96	.01uF, 25/50V Disc	200-0004	R3,54	4.7K ohm, 1/4 Watt	100-3470
C4,71	4.7pF, 500V Disc	200-1004	R4,8,11,14,20,39,41,45	10K ohm, 1/4 Watt	100-4100
C6	680pF, 50V Multilayer	205-0680	R62	10K ohm, 1/4 Watt	100-4100
C8,9,33,46,50,56,77,78	.1uF, 50/100 Disc	200-0005	R5,23,28,46	1K ohm, 1/4 Watt	100-3100
C81,86,89,95,97,98,99	.1uF, 50/100 Disc	200-0005	R6,36,61,64	1K ohm, Trimpot	133-3100
C10,31,57	220pF, 50V Disc	200-0010	R9,25	330 ohm, 1/4 Watt	100-2330
C12,13,14	560pF, 160V Polysterene	202-0022	R10,13,29,47,63	100 ohm, 1/4 Watt	100-2100
C15,84	.1uF, 50V Multilayer	205-1210	R12	680K ohm, 1/4 Watt	100-5680
C16	27pF, 50V Multilayer	205-0027	R17,24,30,44,52,60	100K ohm, 1/4 Watt	1005100
C17	5-50pF, 750V Air Var	204-5050	R18,50	1.5K ohm, 1/4 Watt	100-3150
C22,26	120pF, 50V Multilayer	205-0120	R21,22,32,33,34,35,38	47K ohm, 1/4 Watt	100-4470
C23,24,25	150pF, 50V Multilayer	205-0150	R27	50K ohm, 1/4 Watt	130-4500
C30	2.2uF, 16V Electrolytic	203-8022	R37,53,57	22 ohm, 1/4 Watt	100-1220
C32,41,60,74,80,100	470pF, 50V Multilayer	205-0470	R40	22K ohm, 1/4 Watt	100-4220
C35	47pF, 50V Multilayer	205-0047	R42	10K ohm, Pot	165-4100
C37,62	22pF, 50V Multilayer	205-0022	R48	3.3K ohm, 1/4 Watt	100-3330
C39,40,47,48,51,54	1uF, 50V Electrolytic	203-0006	R49	5.6K ohm, 1/4 Watt	100-3560
C43,44	47uF, 35V Electrolytic	203-0007	R51	10K ohm, Trimpot	133-4100
C49,83,87	100uF, 16V Electrolytic	203-0003	R55	390 ohm, 1/4 Watt	100-2390
C61	12-100pF, 250V Trimmer	204-0010	R56	10 ohm, 1/4 Watt	100-1100
C64,69	100pF, 50V Disc	200-2013	R58	180 ohm, 1/2 Watt	101-2180
C67,68	180pF, 50V Multilayer	203-8022	R59	150 ohm, 1/4 Watt	100-2150
C72	68pF, 50V Multilayer	205 0068	R60	100K ohm, 1/4 Watt	100-5100
C82	10uF, 35V Electrolytic	203-0012	R65,67	220 ohm, 1/4 Watt	100-2220
C91,92,93,94	220pF, 500V Sm	208-0220	R66	500 ohm, Trimpot	130-2500
D1,2,3,4,5,6,7,8,9	1N4148	300-0003	RFC1,2,3,4	10uH, Inductor	401-0102
D10,11	1N4001	300-1004	RFC5	22uH, Inductor	401-0046
D12	MV5753 Red LED	320-0001	RFC6	4.7uH, Inductor	401-0099
D13	Green LED	320-0002	RFC7	4T, Indutor	11-9015-3
H1	2 Position Header	612-0402	RFC8	100uH, Inductor	401-0030
H2	4 Position Header	612-0404	SW1,2	Switch	504-0022
J1	5 Pin Din Connector	611-1005	T1,2,3	25K:1K Inductor	402-3123
J2	2.1MM Coaxial Jack	601-6021	T4	3:1 Transformer	11-9020-1
K1	12V Relay	408-2042	T5	4:1Transformer	11-9420-1
L1,2,5,6	1.8uH, Red Inductor	402-3402	U1,3,6,7	NE602	311-1602
L3	6.5uH Inductor	402-3406	U2	MC1350P	311-1045
L4	15uH, Inductor	401-0043	U4	LM358	311-0386
L7,8	12T Inductor	11-9020-3	U5	TDA7052AN	311-27052
Q1,3	2N5486	305-6004	U8	LM317T	307-1021
Q2,5,6	2N3904	305-0018	U9	78L05AC	307-0010
Q4,7	2N3906	305-0002	Y1,2,3,4,5,6,7	10MHz Crystals	405-0065

20 METER SSB TRAVEL RADIO



Model MFJ-9420

INSTALLATION MANUAL

CAUTION: Read All Instructions Before Operating Equipment

MFJ ENTERPRISES, INC.

P.O. BOX 494, MISSISSIPPI STATE, MS 39762, USA

VERSION 1

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INTRODUCTION:

Congratulations on your choice of the MFJ-9420 20-Meter transceiver. The MFJ-9420 is especially designed to deliver performance you never thought possible from a low-power radio. Please read this manual carefully before attempting to operate your new radio. Let's begin with an introduction to some special features we think you'll like!

EASY TO OPERATE: A "back-to-basics" radio, the MFJ-9420 is simple to use. You'll be operating in minutes!

GREAT SENSITIVITY: Quiet DBM front-end and plenty of overall gain. If the signal is there, you'll hear it!

ANALOG S-METER: Adjust your tuner or aim your beam with pin-point accuracy. A calibrated analog S-meter measures even small variations in signal strength. Meter also monitors your speech-processing level on transmit.

EXCELLENT SELECTIVITY: Sharp ladder filter cuts adjacent chatter and focuses transmitter power where you need it most.

SMOOTH, STABLE VFO: Effortless tuning with custom-manufactured 8:1 reduction-drive ball-bearing VFO tuning capacitor.

POWERFUL AF OUTPUT: Big audio -- even in noisy locations -- from a special Philips BTL audio chip and ruggedized 3" speaker.

FULL-TIME RF SPEECH PROCESSING: Commanding speech cuts through QRM and competes with radios running far more power. Compare it with your 100-watt rig; you'll be amazed by the signal reports!

TRAVEL LIGHT: Packs the same punch as 50 Watt radios without the heavy 10-Amp power supply! Designed to run on NiCd's or the ultra-light MFJ-4110 AC wall-adapter supply.

RUGGED TRANSMITTER: Bullet-proof Motorola PA runs cool, tolerates 3:1 VSWR and accidental feedline shorts or opens.

MADE TO LAST: Conservative design, premium plate-through pc board, quality components, handsome brushed-aluminum panel, and a tough vinyl-clad case ensure years of dependable service.

CW ADAPTER AVAILABLE: Install the MFJ CW adapter board and jump to the low end to work CW. Semi-break-in keying and sidetone.

At home or on the go, you'll enjoy countless hours operating the MFJ-9420. Best of all, it's fully backed by MFJ's exclusive "No Matter What" 1-year guarantee. If it breaks, we'll take care of it!

QUICKSTART INSTRUCTIONS:

You'll need three things to get your MFJ-9420 on the air fast:

[] 12-14 Volt 2-Amp Power Source.
[] 600-Ohm Dynamic PTT Microphone
[] 20-Meter Antenna

1. POWER SUPPLY: The MFJ-4114 AC/NiCd Portable Power Pack or MFJ-4110 AC Wall-adapter Supply are especially designed to run the MFJ-9420. You may also use any 13.8-Volt supply or 10-cell NiCd pack as long as it delivers 2-A on peaks (12-Volt supplies will work fine -- but at reduced RF output). Use a 5.5mm OD x 2.1mm coaxial-type power plug (Radio Shack 274-1567) with (+) connected to the center pin:

2. MICROPHONE: The MFJ-9420 speech processor circuit was designed around the companion MFJ-290 600-Ohm Dynamic Microphone. Radio Shack's 21-1172 replacement microphone also plugs in without modification and works well. If the mike you select requires a plug, install a 5-Pin DIN connector (Radio Shack 274-003) as shown:

Pin 3: PTT Line
Pin 4: Mic Line
Pin 1,2,5: Ground

3. ANTENNA: The MFJ-9420 will function with any 20-Meter antenna exhibiting a VSWR of 3:1 or less (your home station antenna or the MFJ-1772 Portable Dipole should work fine). AVOID USING ANTENNAS WITH UNKNOWN OR HIGH VSWR. The MFJ-9420 PA is not protected by high-VSWR shutdown circuitry and you may generate out-of-band parasitics if a high VSWR load is present.

IMPORTANT OPERATING NOTES:

[] Your MFJ-9420 features a very potent speech processor. PLEASE RESIST THE NATURAL TEMPTATION TO SHOUT OR CLOSE-TALK THE MICROPHONE IN ORDER TO BE HEARD! Instead, hold the mic about 2" away and speak normally. The S-Meter should deflect about 1/2 scale as you speak -- although this may vary somewhat with antenna load. When operating in noisy environments, you may find it necessary to turn down the mic gain control (a screwdriver adjustment located on back panel) to reduce background noise.

[] The MFJ-9420 uses an analog VFO tuning dial which is inherently less accurate than digital readouts (on the plus side, analog tuning reduces phase noise, lowers power consumption, and saves you money). Please take the potential for dial error into account when operating near the edge of your authorized sub-band.

TECHNICAL SPECIFICATIONS:

RECEIVER SECTION:

Frequency Coverage:	14.150-14.350 MHz (14.000-14.100)*
Receiver Type:	Single conversion superhet
VFO Frequency:	4.150-4.350 MHz (4.000-4.100)*
IF Frequency:	10 MHz
IF Selectivity:	-6 dB at 2.5 KHz
AGC:	Audio-derived
Sensitivity:	<.5 uV for 12 dB S/N
Audio:	>1 Watt into 8 Ohms at 10% THD
Receive Current:	50-100 mA typical

TRANSMITTER SECTION:

RF Power Output:	10W Average Speech (8-10W CW)*
VSWR Tolerance:	3:1 VSWR
Maximum Current:	2.2 Amps peak at 13.8 VDC
Audio Enhancement:	RF-compression processor

* Requires CW adapter module

BLOCK DIAGRAM:

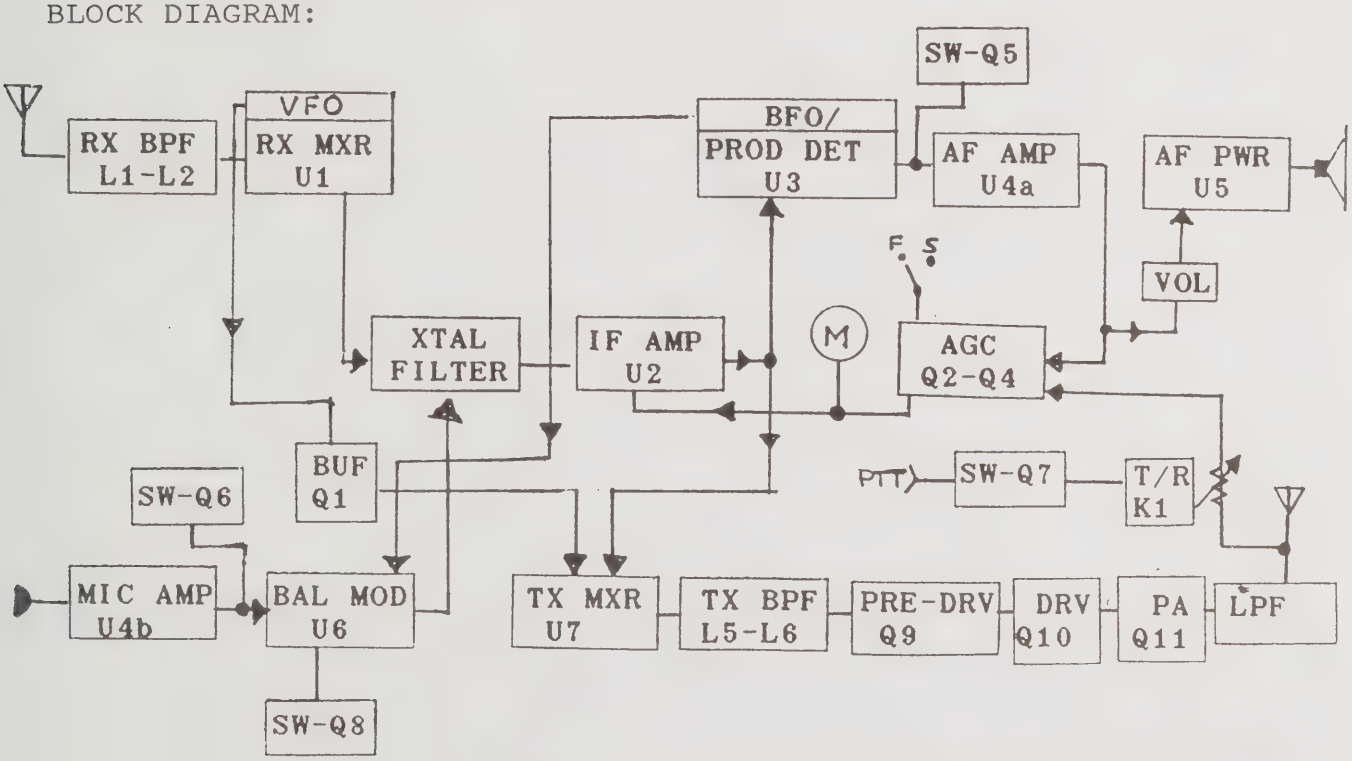


Figure 1.

THEORY OF OPERATION: Please refer to Figure 1.

RECEIVER: Four-pole bandpass filter L1-L2 preselects incoming 14-MHz signals. Active mixer U1 amplifies and converts signals to 10-MHz using a self-generated 4-MHz VFO signal. Crystal ladder filter Y1-Y6 sets message-channel bandwidth (diode-switching routes transmit and receive signals through the filter and U2). IF-amplifier U2 provides AGC-controlled IF gain in RX and RF-compression speech processing in transmit.

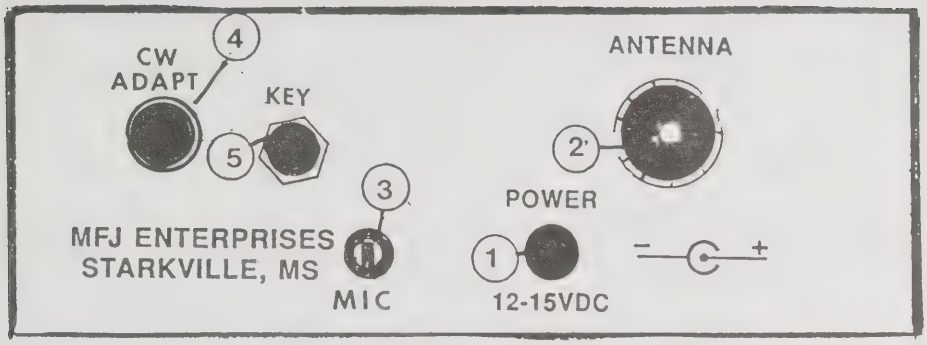
DC amplifier Q3/Q4 drives the AGC input of U2 and the S-meter circuit. In RX, AGC is audio-derived from AF pre-amp U4a (switch Q2 sets slow AGC decay for SSB reception). On transmit, processor control voltage is derived from PA level-detector D9 (Q2 sets fast decay for processor).

Receiver product detector U3 demodulates incoming SSB signals (10-MHz LO is self-generated by U3). U3's audio output feeds U4a, a preamp and active LP audio filter. U4a drives ACG detector D6/D7 (input to U4a is killed by switch Q5 during TX to disable the AGC path to U2). U4a also drives AF power amplifier U5 through the volume control. U5, which powers the speaker during RX, is gated into standby during TX to prevent residual feedthrough.

TRANSMITTER: Microphone speech amp U4b drives balance modulator U6 during TX (switch Q6 kills U4 output to prevent mic bleed-through via U6/U2 during RX. LO for U6 is derived from U3's BFO oscillator. Q8 is used to unbalance U6 for carrier or CW generation. DSB output from U6 is routed to Y1-Y6 via switch D1/D2 for removal of LSB products and carrier artifacts. After undergoing dynamic compression in U2, the processed USB signal is routed to transmitter mixer U7 by switch D3/D4 -- where it is mixed with 4-MHz VFO (VFO signal is sampled from U1's oscillator and buffered by Q1). Bandpass filter L5-L6 selects the 14-MHz mixer product and feeds it to pre-driver Q9. Q9 feeds driver Q10. Q10 drives PA stage Q11. Q11 operates in single-ended class-AB with bias generated by clamping-diode D10. T5 matches PA output to a 50-Ohm system, and low-pass filter L7-L8 suppresses harmonic content. Level-detector D9 tracks the SSB speech envelope and generates feedback to Q3/Q4 and U2. Dynamic compression of the speech waveform optimizes average transmitter output power. The MFJ-9420 is especially designed to operate from light-weight constant-current power sources such as NiCd cells or the MFJ wall-adapter AC supply.

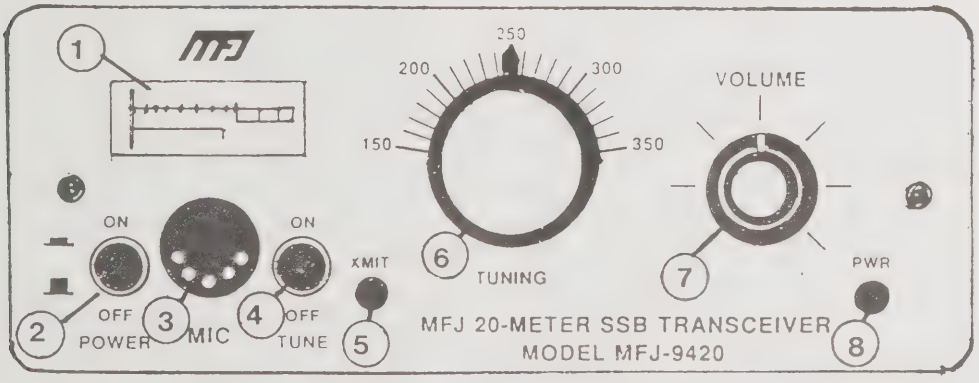
SWITCHING AND REGULATION: Q7 activates relay K1, which routes the antenna line and activates the +T and +R buses (+T and +R buses power some stages, key switch nodes, and bias Q11 on during TX). Adjustable-regulator U8 sets Vcc for low-level stages. Fixed regulator U9 sets U1 operating voltage to ensure VFO stability. Crowbar diode D11 and a pc-track fuse protect the radio from reverse polarity.

MFJ-9420 CONTROL LOCATION AND FUNCTION:



REAR PANEL

1. POWER JACK: 5.5mm OD, 2.1mm ID, (+) to center pin.
2. ANTENNA JACK: SO-239 for standard coax plugs.
3. MIC GAIN: Sets Speech-amp Gain (normal setting 12:00).
4. CW ADAPT: Engages CW adapter (accessory).
5. KEY: Accepts straight key or keyer.



FRONT PANEL

1. METER: Show signal strength on RX, ALC on TX.
2. POWER SWITCH: Turns power on to transceiver.
3. MIC: 5-Pin Din Jack for Dynamic Microphone.
4. TUNE: Injects carrier for ATU adjustments.
5. XMIT: LED illuminates when transmitting.
6. TUNING: Tunes in stations, indicates VFO frequency.
7. VOLUME: Adjusts listening level.
8. PWR INDICATOR: LED illuminates when power on.

SETTING UP YOUR MFJ-9420 PORTABLE STATION:

To put your MFJ-9420 station in operation, you'll need a power source, a 20-Meter antenna, and a microphone. Here are some specific suggestions to help you get started:

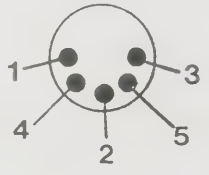
POWER SOURCE: 12-15 V @ 2A (+) TO CENTER PIN

The MFJ-4114 AC/DC PORTABLE POWER PACK and MFJ-4110 AC WALL-ADAPTER SUPPLY are especially designed for your radio. However, you may use any filtered DC power source capable of delivering 12-15 volts at 2 Amps (13.8V required for full RF output). The DC power connector at the rear of your MFJ-9420 is a 5.5mm OD, 2.1mm ID coaxial type jack. Extra plugs are available from Radio Shack stores (#274-1567). Always connect plus (+) to the CENTER PIN.

MICROPHONE: USE 600-OHM DYNAMIC

The MFJ-9420 speech circuit is designed especially for a 600-Ohm dynamic microphones such as the MFJ-290 (the MFJ-290 is supplied if you purchase the MFJ-9420M package). You may also use other suitable 600-Ohm desk or hand mics by installing a 5-pin DIN plug (Radio Shack #274-003). See installation diagram below:

PTT - pin 3
MIC - pin 4
GND - pins 1,2,5.



WARNING:

NEVER USE AN AMPLIFIED MICROPHONE WITH YOUR TRANSCEIVER. The speech processor already has extremely high gain and may distort severely if overdriven by a "power mike".

ANTENNA REQUIREMENTS: VSWR 3:1 OR LESS .

The MFJ-9420 accepts most 20-Meter antennas with a VSWR of 3:1 or less. Use your regular station antenna or a portable 20-Meter dipole such as the MFJ-1772 ultra-light. For non-resonant wires, use a tuner such as the MFJ-971. Always "rough-tune" for maximum receiver sensitivity first using incoming signals and your S-Meter to find a peak. AVOID OPERATING INTO UNMATCHED HIGH-VSWR ANTENNAS. THE MFJ-9420 DOES NOT HAVE A HIGH-VSWR SHUTDOWN CIRCUIT AND BADLY-MISMATCHED LOADS COULD RESULT IN TRANSMITTER INSTABILITY AND GENERATION OF OUT-OF-BAND SIGNALS!

STEP-BY-STEP INSTRUCTIONS -- USING YOUR MFJ-9420 TRANSCEIVER:

STEP 1. Connect a suitable microphone, power source, and 20-Meter antenna.

STEP 2. Turn VOLUME fully counter-clockwise (down) and press ON switch to power up radio. PWR indicator should light.

STEP 3. Turn VOLUME clockwise for a comfortable listening level.

STEP 4. If you are using an antenna tuner, adjust ATU controls for strongest received signals or maximum background noise on the S-meter. Then, press CARRIER to generate a steady RF signal for final adjustment. Red XMIT indicator should light.

STEP 5. The VFO tuning range covers 14.150 - 14.350 MHz and the MFJ-9420 tuning dial was carefully calibrated at the factory. However, it is -- by nature -- an analog frequency readout that may be subject to some inaccuracy or misinterpretation. To ensure compliance with FCC rules, we suggest the following:

(a.) Periodically check the VFO dial with a digital transceiver or counter to confirm location of band-edges.

(b.) Avoid transmitting on the margins of your allocation unless you are certain the station you are calling is in "in band".

STEP 6. To transmit, press the mike's PTT switch and speak at normal conversational level with the mike held about 2 inches from your mouth. The MFJ-9420 has a very potent speech processor and will pick up your voice at full intensity. Avoid the natural temptation to yell or close-talk -- this will only overload the processing circuit and hurt the intelligibility of your signal!

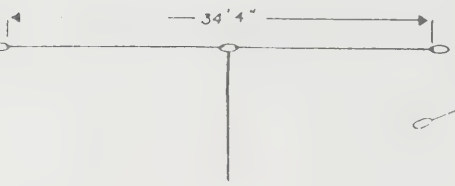
SPECIAL OPERATING NOTES:

The MFJ-9420 does not have automatic high-VSWR shutdown and you must provide a "reasonable" 20-Meter antenna to ensure proper operation. Whenever possible, use a low-SWR resonant-type antenna such as a dipole or tuned vertical. If you use an ATU (or a high-Q loop such as the MFJ-1786 or Isopole 10-30), carefully rough-tune first for maximum S-meter readings before activating the CARRIER switch.

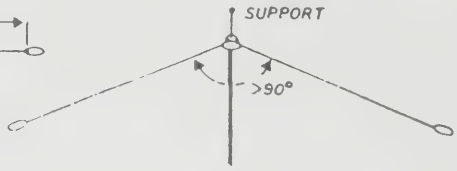
Under FCC Rules, licensed amateurs are solely responsible for the frequency of operation of their transmitters. MFJ cannot be held responsible for out-of-band operation due to misinterpretation or miscalibration of the MFJ-9420 analog VFO dial.

SIMPLE 20-METER ANTENNA SUGGESTIONS:

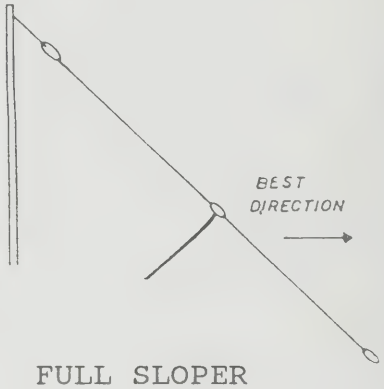
COAXIAL-FED DIPOLES: A wire dipole for the phone band should measure about 32'10" (16'5" per leg). Feed with RG-58U or RG-8X; raise high and in the clear for best performance. If you have only one high support, make an inverted V. The "full sloper" (sloping dipole) is also an excellent single-support antenna with some directivity.



DIPOLE

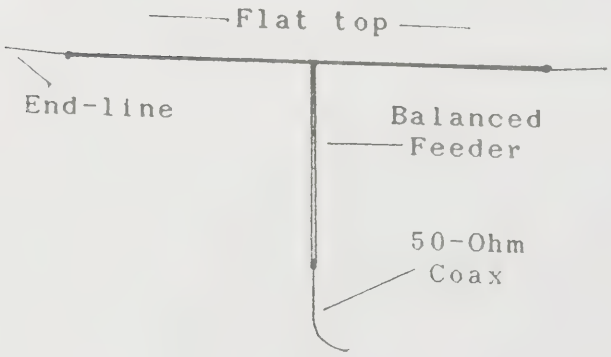


INVERTED V

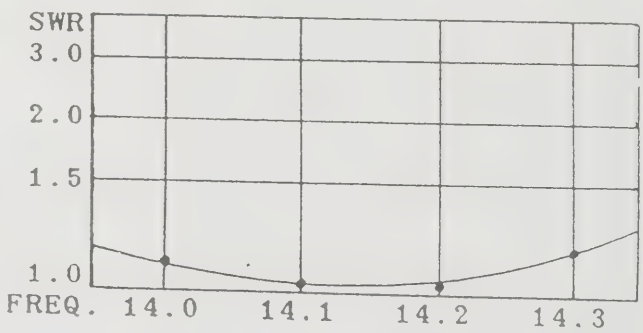


FULL SLOPER

MFJ-1772 PORTABLE DIPOLE: As an alternative to making a coax-fed dipole, consider purchasing the pre-assembled MFJ-1772 antenna. This is a no-compromise 20-Meter folded dipole complete with 30' of feedline -- all made from ultra light-weight 300-Ohm twinlead. Connect a random length of coax from the MFJ-1772 feedline to your rig and let the antenna's built-in 50-Ohm matching network do the rest. The antenna is pre-tuned, easy to handle, and sufficiently broad-banded to cover both the CW and phone band.



MFJ 1772 DIPOLE



TYPICAL SWR CURVE

WARNING: CONSTRUCTING OR ERECTING AMATEUR RADIO ANTENNAS IN LOCATIONS WHERE THEY MAY COME INTO CONTACT WITH ELECTRICAL POWER LINES MAY RESULT IN ACCIDENTAL INJURY OR DEATH!

GETTING THE MOST FROM YOUR MFJ-9420 STATION:

While spanning the globe with a small portable rig like the MFJ-9420 may SOUND difficult, it really isn't. High power and big antennas have never been a requirement for world-wide radio communication -- and still aren't. Despite the vast distances involved, hams consistently reach every corner of the planet running far less power than your MFJ-9420. How do they do it? Here are some proven tips guaranteed to work:

GROOM YOUR ANTENNA:

Inspect and clean all traps and contacting surfaces. Replace corroded hardware, dirty connectors, and aging coax. Retune for minimum SWR in the phone band.

Raise wire dipoles high and in the clear -- 40 to 60 feet is far better than 10 or 20. Carefully prune for minimum SWR. If you have only one high support, install an inverted V or sloper.

Multiband verticals (1/4-wave types) require at least 4 good 14-MHz radials -- add them if needed. Clean up corrosion and adjust your top section for minimum SWR in the phone band.

Avoid "compromise" antennas. When it comes to pure operating enjoyment, every dB you gain at the antenna pays big dividends!

USE PROVEN DX OPERATING TECHNIQUES:

Be a good listener -- search out and answer CQs, or call stations that have just completed QSOs (a practice called tailgating).

Never hesitate to call a weak station -- it may be QRP or using a marginal antenna. You may be much louder than you think!

Be realistic about diving into huge 20-meter pileups. Once a choice DX station hits the packet clusters and the big guns move in, calling may be a waste of time until the smoke clears.

Tune slowly and listen carefully. If one exotic station is coming through, there may be others you can work nearby.

Pay attention to DX forecasts and gray-line propagation. When the band is hot, power difference become much less significant. Operating just before the band goes out at night may yield strong signal reports from exotic locations with little QRM.

Don't be shy about calling. The MFJ-9420 has very potent audio and on-air tests indicate its signal is competitive with higher-powered radios. If your antenna is good, most stations won't even know you are running low power!

IN CASE OF TROUBLE, CHECK IT OUT FIRST -- THEN CALL US AT 800 647-TECH (800 647-8324): Your MFJ-9420 is fully backed for 1 year by MFJ's "NO MATTER WHAT GUARANTEE". After that, MFJ Customer Service Technicians will be there to help you keep your rig in top shape for as long as you own it. However, before you call us, please check through this list -- just to make sure the problem isn't something simple you can fix yourself!

1. RADIO DOES NOT POWER UP
 [] Is power plug okay, broken supply wire?
 [] Is supply or battery functional?
 [] Is reverse-polarity fuse open?

2. NO SIGNALS RECEIVED
 [] Is antenna disconnected or broken?
 [] Is TUNE switch stuck on?
 [] Is the band dead?

3. RADIO DOES NOT TRANSMIT OR KEYS ERRATICALLY
 [] Is microphone and connector okay?

4. ERRATIC TRANSMIT
 [] Is SWR high (above 3:1)?
 [] Is power source voltage low or "soft" under load?

5. AGC IS INEFFECTIVE OR S-METER IS NOT ZEROED
 [] Is Regulator okay (10.0 V on TP1)?
 [] Is AGC okay (4.3 on TP2?)
If TP1, TP2 okay and AGC works, rezero meter via R51.

6. RADIO DRIFTS IN FREQUENCY
 [] Is radio sitting in Sun, on hot surface, in cold draft?
 [] Was radio moved from extreme cold to warm (condensation)?
If you suspect condensation, allow radio to fully dry out.

7. POOR CARRIER SUPPRESSION
 [] Was radio moved from extreme cold to warm (condensation)?
 [] Was radio exposed to rough handling or shock?
To null, unplug mic and ground pin 3 to key radio. Adjust R36 and T3 for minimum carrier (monitor using a second receiver).

8. LOW TRANSMIT AUDIO:
 [] Is the mic a 600-ohm dynamic type?
 [] Is the MIC GAIN set too low?

9. NOISE ON TRANSMIT AUDIO:
 [] Is MIC GAIN set too high in a noisy room?
 [] Is mic next to a power transformer or motor?

If these checks don't uncover the problem, or if you don't feel qualified to make the prescribed adjustments, please call us for help at 800 647-TECH (800 647-8324).

FIELD ALIGNMENT PROCEDURES FOR THE MFJ-9420 TRANSCEIVER:

SPECIAL TOOLS, PARTS, TEST EQUIPMENT:
- AC Power Supply, 13.8 Volts @ 2 Amps
- Voltmeter
- Non-inductive Alignment Tool kit
- Frequency Counter
- Wattmeter with 50-Ohm Resistive Dummy Load
- 14-MHZ Signal Generator or other weak signal source
- General Coverage Receiver with digital readout

INITIAL TEST SET-UP:
- A. Remove transceiver cover.
- B. Connect 13.8 Volts Power Supply to Power Jack.
- C. Connect Microphone.
- D. Turn on unit.

VOLTAGE CHECKS AND ADJUSTMENTS: (use voltmeter)
- A. VOLTAGE REGULATOR: Set R64 for 10.0 V at TP1.
- B. RECEIVER AGC: Set R6 for 4.3 Volts at TP2.

VFO CALIBRATION:
- A. Tune VFO dial to 14.250 MHz (mid-band).
- B. Connect counter probe to U7 pin 6
- C. Adjust L3 for 4.255 MHz readout.

BFO FREQUENCY CHECK AND ALIGNMENT:
- A. Tune across 14.250 MHz. test signal (use generator).
- B. Identify 2 peaks in passband by watching S-meter.
- C. Carefully set VFO dial to lower-frequency response peak.
- D. Adjust BFO trimcap (C61) until CW note is 600 Hz.
- E. Recheck. First peak should be at 600 Hz, second peak around 2000 Hz. Pitch of CW tones should go DOWN as you tune UP in frequency, indicating USB operation.

CARRIER NULL: (use a second receiver to monitor beat note)
- A. Short mic pin 4 to ground to kill mic pickup.
- B. Key mic and monitor signal slightly off-frequency.
- C. Alternately adjust R36 and T3 for minimum carrier.

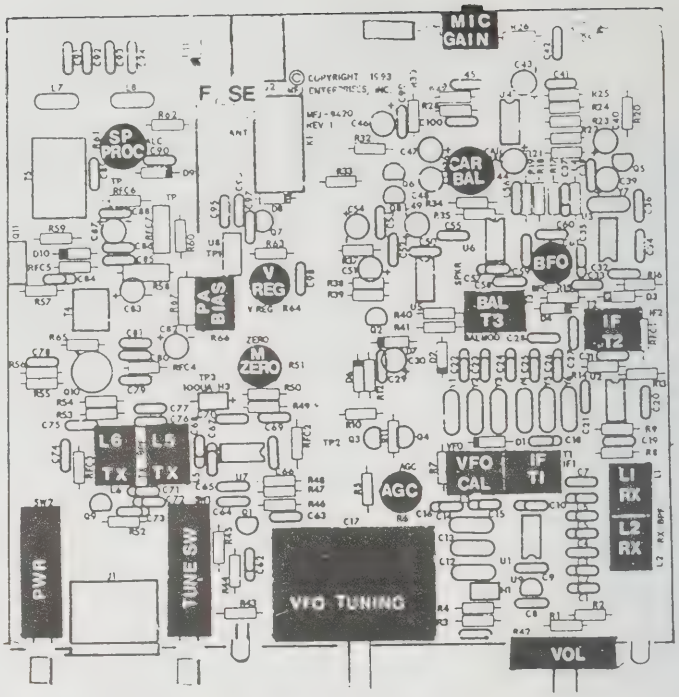
RECEIVER SENSITIVITY CHECK:
- A. Connect weak 14.250-MHz signal source to antenna jack.
- B. Tune in signal source for maximum S-meter reading.
- C. Touch up L1,L2,T1,T2 for max SIG Meter reading.

TRANSMITTER BANDPASS FILTER AND COMPRESSOR ALIGNMENT:
- A. Connect QRP Wattmeter with dummy load to ANT Jack.
- B. Turn R61 full CW, Press Carrier Switch (SW2).
- C. Carefully touch up L5 and L6 for peak output.
- D. Turn R61 CCW until RF output power drops by 10%.

If radio fails to operate properly after following these procedures, call 800 647-8324 for help.

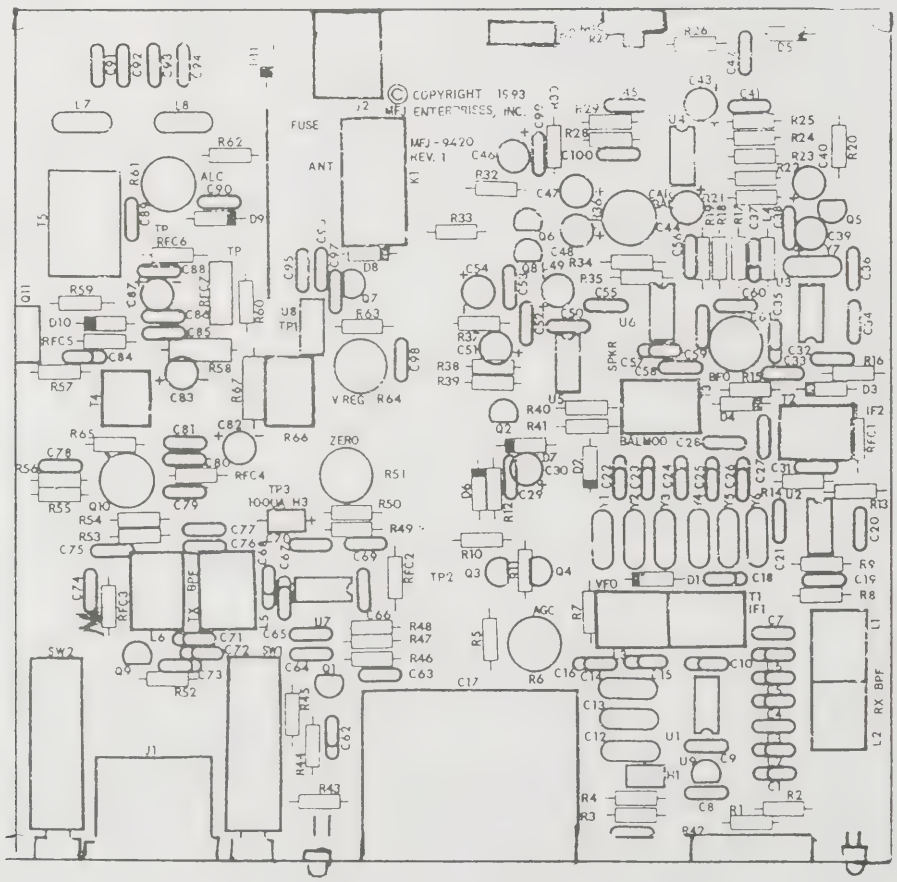
INTERNAL ADJUSTMENT LOCATIONS:

[] V-REG: Regulator voltage
[] AGC: U2 AGC threshold
[] M-ZERO: Panel meter zero
[] BFO: Carrier osc. freq.
[] VFO CAL: VFO freq. adj.
[] IF1,IF2: IF ampl. peak
[] L1,L2: RX front-end peak
[] L5,L6: TX filter peak
[] CAR-BAL,T3: Carrier null
[] PA BIAS: PA idle current
[] SP PROC: TX ALC level
[] MIC GAIN: TX audio level
[] TUNE SW: Full carrier out
[] PWR: Power on
[] VOL: AF Ampl. gain control
[] VFO TUNE: Sets operating freq.
[] FUSE: Reverse-polarity protect



*If reverse-polarity track-fuse opens, install a miniature 2.5-A pigtail fuse or a 3/4" hair-pin loop of #32 wire.

PARTS PLACEMENT, MFJ-9420:



DC VOLTAGE CHART - TROUBLESHOOTING GUIDE:

For advanced troubleshooters, the following are typical DC voltages found in the MFJ-9420.

Vcc = 13.8 (Supply Voltage)
TP1 = 10.0 (LM-317 Output)
TP2 = 4.3 (AGC Bias Voltage)

INTEGRATED CIRCUITS:

		-------- RX----------				--TX--	
Pin	U1	U2	U3	U4	U5	U6	U7
1							
2							
3							
4							
5							
6							
7							
8							

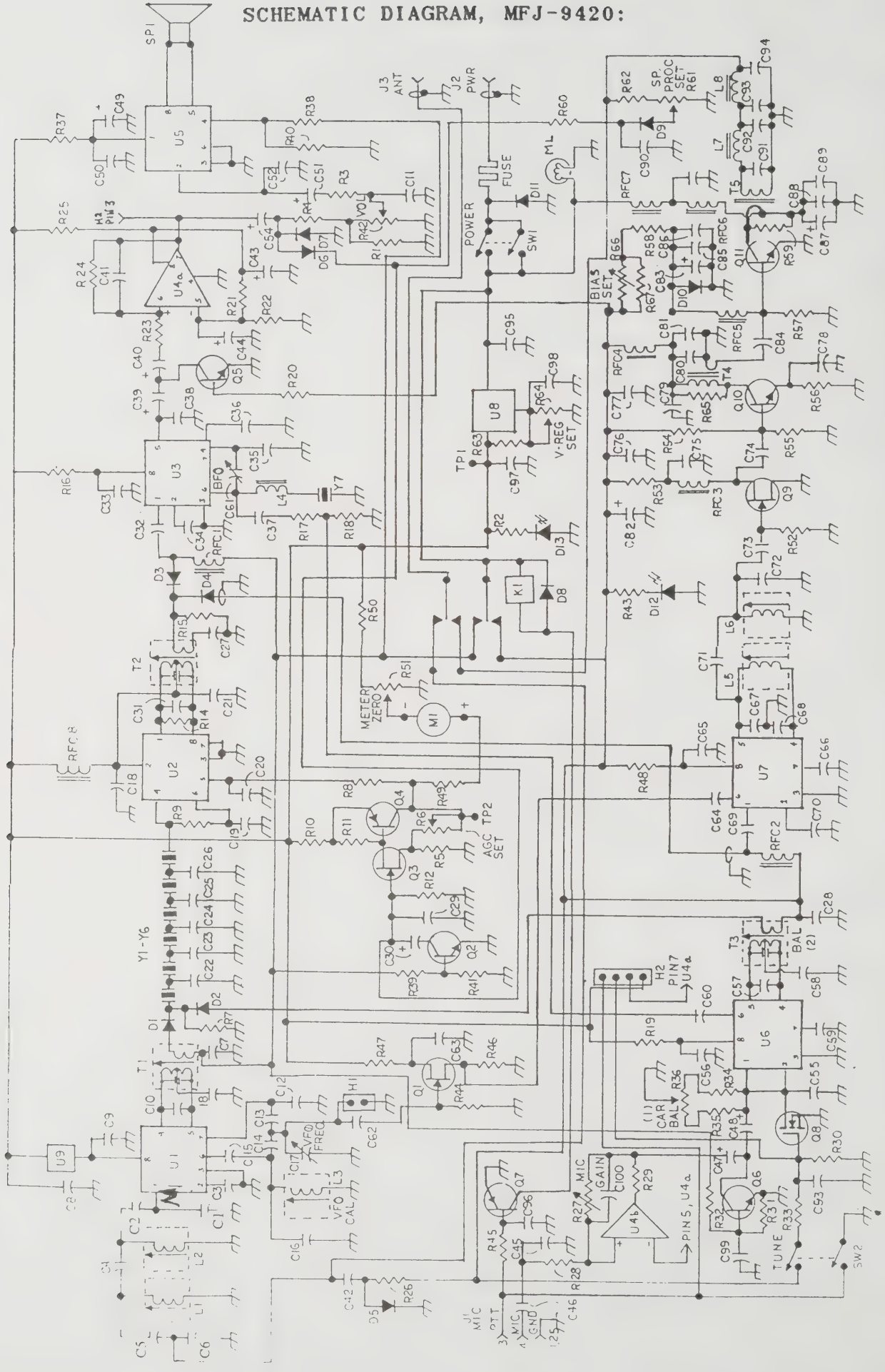
BIPOLAR AND JFET DEVICES:

D/E = Drain/Emitter
S/B = Source/Base
G/C = Gate/Collector
* = Check in transmit

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
D/E										
S/B										
G/C										

PA Q11: To avoid meter damage from RF, check Q11's collector in receive mode; full supply voltage should be present. Check base (bias) with PTT pressed; it should indicate about 0.6 VDC.

SCHEMATIC DIAGRAM, MFJ-9420:



MFJ-9420 Parts List

DESIGNATION	DESCRIPTION	MFJ PARTS #	DESIGNATION	DESCRPTION	MFJ PARTS #
C1,5,73	100pF, 50V Multilayer	205-0100	Q8	VN10KM	305-6005
C2	560pF, 50V Multilayer	205-0005	Q9	J310	305-6310
C3,7,11,18,19,20,21,27	.01uF, 25/50V Disc	200-0004	Q10	2N5109	305-0017
C28,29,34,36,38,42,45,52	.01uF, 25/50V Disc	200-0004	Q11	MRF-477	305-5477
C53,55,58,59,63,65,66,70	.01uF, 25/50V Disc	200-0004	R1,2,7,15,16,19,26,43	2.2K ohm, 1/4 Watt	100-3220
C75,76,79,85,88,90,96	.01uF, 25/50V Disc	200-0004	R3,54	4.7K ohm, 1/4 Watt	100-3470
C4,71	4.7pF, 500V Disc	200-1004	R4,8,11,14,20,39,41,45	10K ohm, 1/4 Watt	100-4100
C6	680pF, 50V Multilayer	205-0680	R62	10K ohm, 1/4 Watt	100-4100
C8,9,33,46,50,56,77,78	.1uF, 50/100 Disc	200-0005	R5,23,28,46	1K ohm, 1/4 Watt	100-3100
C81,86,89,95,97,98,99	.1uF, 50/100 Disc	200-0005	R6,36,61,64	1K ohm, Trimpot	133-3100
C10,31,57	220pF, 50V Disc	200-0010	R9,25	330 ohm, 1/4 Watt	100-2330
C12,13,14	560pF, 160V Polysterene	202-0022	R10,13,29,47,63	100 ohm, 1/4 Watt	100-2100
C15,84	.1uF, 50V Multilayer	205-1210	R12	680K ohm, 1/4 Watt	100-5680
C16	27pF, 50V Multilayer	205-0027	R17,24,30,44,52,60	100K ohm, 1/4 Watt	1005100
C17	5-50pF, 750V Air Var	204-5050	R18,50	1.5K ohm, 1/4 Watt	100-3150
C22,26	120pF, 50V Multilayer	205-0120	R21,22,32,33,34,35,38	47K ohm, 1/4 Watt	100-4470
C23,24,25	150pF, 50V Multilayer	205-0150	R27	50K ohm, 1/4 Watt	130-4500
C30	2.2uF, 16V Electrolytic	203-8022	R37,53,57	22 ohm, 1/4 Watt	100-1220
C32,41,60,74,80,100	470pF, 50V Multilayer	205-0470	R40	22K ohm, 1/4 Watt	100-4220
C35	47pF, 50V Multilayer	205-0047	R42	10K ohm, Pot	165-4100
C37,62	22pF, 50V Multilayer	205-0022	R48	3.3K ohm, 1/4 Watt	100-3330
C39,40,47,48,51,54	1uF, 50V Electrolytic	203-0006	R49	5.6K ohm, 1/4 Watt	100-3560
C43,44	47uF, 35V Electrolytic	203-0007	R51	10K ohm, Trimpot	133-4100
C49,83,87	100uF, 16V Electrolytic	203-0003	R55	390 ohm, 1/4 Watt	100-2390
C61	12-100pF, 250V Trimmer	204-0010	R56	10 ohm, 1/4 Watt	100-1100
C64,69	100pF, 50V Disc	200-2013	R58	180 ohm, 1/2 Watt	101-2180
C67,68	180pF, 50V Multilayer	203-8022	R59	150 ohm, 1/4 Watt	100-2150
C72	68pF, 50V Multilayer	205 0068	R60	100K ohm, 1/4 Watt	100-5100
C82	10uF, 35V Electrolytic	203-0012	R65,67	220 ohm, 1/4 Watt	100-2220
C91,92,93,94	220pF, 500V Sm	208-0220	R66	500 ohm, Trimpot	130-2500
D1,2,3,4,5,6,7,8,9	1N4148	300-0003	RFC1,2,3,4	10uH, Inductor	401-0102
D10,11	1N4001	300-1004	RFC5	22uH, Inductor	401-0046
D12	MV5753 Red LED	320-0001	RFC6	4.7uH, Inductor	401-0099
D13	Green LED	320-0002	RFC7	4T, Indutor	11-9015-3
H1	2 Position Header	612-0402	RFC8	100uH, Inductor	401-0030
H2	4 Position Header	612-0404	SW1,2	Switch	504-0022
J1	5 Pin Din Connector	611-1005	T1,2,3	25K:1K Inductor	402-3123
J2	2.1MM Coaxial Jack	601-6021	T4	3:1 Transformer	11-9020-1
K1	12V Relay	408-2042	T5	4:1Transformer	11-9420-1
L1,2,5,6	1.8uH, Red Inductor	402-3402	U1,3,6,7	NE602	311-1602
L3	6.5uH Inductor	402-3406	U2	MC1350P	311-1045
L4	15uH, Inductor	401-0043	U4	LM358	311-0386
L7,8	12T Inductor	11-9020-3	U5	TDA7052AN	311-27052
Q1,3	2N5486	305-6004	U8	LM317T	307-1021
Q2,5,6	2N3904	305-0018	U9	78L05AC	307-0010
Q4,7	2N3906	305-0002	Y1,2,3,4,5,6,7	10MHz Crystals	405-0065

FULL 12 MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original of machine reproduction or such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, of forgery shall be cause to void any and all warranty terms immediately.

2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **$7.00** covering postage and handling.

3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof of purchase and a **$5.00** personal check, cashiers check, or money order must be provided to cover postage and handling.

4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.

5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.

6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned.** Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaired.

7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.

8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.

9. This warranty is given in lieu of any other warranty expressed or implied.

10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.

11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to **MFJ Enterprises, Inc., 921A Louisville Road, Starkville, Mississippi 39759, USA** and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.

12. This warranty gives you specific rights, and you may also have other rights which vary from state to state.